

PATENT APPLICATION
Docket No.: N.C. 80,253

REMARKS

Claims 1-7 are pending in the application. Claim 7 has been added by this amendment.

Claims 1 and 4 are amended to cancel the recitation that only the trailing signal is processed. This clause is unnecessary, as claims 1 and 4 do not recite any processing of any other signals. This is not a narrowing amendment. The amendment also resolves a contradiction with claim 2, dependent on claim 1, in which the processing of additional signals is recited.

Claims 1-4 are amended to correct indefiniteness as described below in the response the 35 U.S.C. 112, second paragraph rejections.

New claim 7 recites a specific method of comparing the reference signal to the trailing signal. Support for this amendment is found in paragraph 24.

The Examiner has rejected claims 1-6 under 35 U.S.C. 103(a) as being unpatentable over JP-137504 (Toda et al.).

The invention of claim 1 is to a method of measuring the thickness of a coating 12 on a substrate 14. The coating is between a fluid 16 and the substrate. A transducer transmits a broad band ultrasonic signal through the fluid towards the coating layer. The reflected signal is measured. The reflected signal contains a backscattered signal from the fluid/coating interface and a trailing signal from the coating/substrate interface. There is a time delay after the backscattered signal is received before the trailing signal is received. FFT is performed on the trailing signal. The peak frequency is the resonant frequency of the coating and is used to calculate the coating thickness.

Toda discloses a method of measuring the thickness of a coating film 14 on a substrate 15. An ultrasonic probe 13 is placed in contact with the film or substrate (Fig. 3a). The probe transmits an ultrasonic pulse have both low and high frequency components. An echo is detected and subjected to FFT. The transformed echo contains two frequency peaks. One peak is normalized against the other peak. The normalized peak is used to calculate the thickness of the film.

Some of the terms and methods in the translated sections of Toda are not entirely clear. The following is Applicants' best interpretation of Toda. Fig. 3a shows two reflected signals, one from the film/substrate interface, and one from the other side of the film. The reflected

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signal from the film/substrate interface is not used. It could not contain information about the coating, as this signal never enters the coating. Only the signal reflected off the other side of the coating is used. This signal is the "surface echo or underside echo." It can arbitrarily be said that in Fig. 3a, the probe is on the "surface" and the signal is reflected from the "underside." This designation of the surfaces is absolute, not relative to the position of the probe, as the probe can be placed either "inside or outside." Thus, the probe may also be placed on the underside to measure the surface echo. This is the only way to reconcile the facts that either the surface echo or underside echo may be used and that the probe may be placed either inside or outside.

The echo contains information about the thickness of both the coating and the substrate. That is why the FFT produces two peaks. (To reiterate the point in the previous paragraph, an echo from the film/coating interface would contain only one peak, so this cannot be the signal that is used.) One peak is normalized, with the other used as a basis, to calculate the thickness of the film. It is not stated how this works. It is believed that the thickness of the substrate is known and is used in the normalization to produce the thickness of the film. Regardless of how the normalization is done, it appears that information about the substrate, found in the second peak, is required to determine the thickness of the coating.

The invention of claim 1 differs from Toda in several ways. The first is that in Toda, the probe is placed in direct contact with either the film or the substrate. In the present claim 1, there is a fluid between the transducer and the coating. The transducer is not in contact with the coating, or else there would be no fluid/coating interface. This limitation is not disclosed or suggested in Toda. "To establish *prima facie* obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art." MPEP 2143.3.

Secondly, in Toda, the reflected signal contains two frequency peaks, while in the present claim 1, there is only one peak, the resonant frequency of the coating. Toda does not disclose or suggest a method of measuring the film thickness using only one peak. It appears that Toda requires information about the substrate to calculate the film thickness, while the present invention does not.

Thirdly, the composition of the transmission pulse in Toda is not clear. It is described as "containing pulse components of frequencies being low and high." This description does not

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necessarily include the frequencies between the low and high frequencies. However, the present claim 1 uses a single broad band of frequencies. It cannot be concluded that this limitation is disclosed or suggested in Toda.

Finally, Toda measures a surface echo or an underside echo, while the present claim 1 uses a trailing signal. The Examiner stated that it would be obvious to determine which echo in Toda was the trailing signal. However, these are different signals. The echoes of Toda pass through both the film and the substrate. The trailing signal of the present claim 1 passes through only the coating (and the fluid). The trailing signal cannot be used in the method of Toda as it has only one peak, the resonant frequency of the coating. Toda does not disclose or suggest using the trailing signal of the present claim 1. Toda would be inoperable if it were modified in this way.

In order to make out a *prima facie* case of obviousness under 35 U.S.C. 103, the rejection must be supported by some reason, suggestion, or modification from the prior art as a whole that indicates that the person of ordinary skill would have combined or modified the references. The motivation must be found in a "specific hint or suggestion in a particular reference." *In re Lee*, 61 U.S.P.Q.2d 1430, 1434, 277 F.3d 1338 (Fed. Cir. 2002).

The Examiner has not cited a motivation that is found in the references, but has only stated the conclusion that the combination is obvious. The suggested modification of determining which echo to analyze as the trailing signal would result in an inoperable process as explained above. There is nothing in Toda to suggest or motivate such a modification.

Further, the Examiner has not made findings as to the likelihood of success or the level of skill in the art, as required under MPEP 2143.02 and 2141.03.

As to claim 2, the Examiner stated that Toda obtains two peaks and uses one peak to normalize the other. The present claim 2 recites using a main transmitting signal or reference signal of the main transmitting frequency to deconvolve signal artifacts from the trailing signal. The peaks in Toda are different from the peaks in claim 2. The peaks in Toda are part of a single echo, one peak for each of the film and the substrate. The peaks in claim 2 are the reference frequency of the transmitted signal and the resonant frequency of the coating. The two peaks are found in different signals: the backscattered signal for the reference frequency and the trailing signal for the resonant frequency. The reference frequency is then subtracted from the trailing

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signal. The additional limitations of claim 2 are not found in Toda. New claim 7 recites the specific method of comparing the reference signal to the trailing signal.

Claim 3 depends from and contains all the limitations of claim 1 and is asserted to distinguish from the references in the same manner as claim 1.

Claims 4-6 are to an apparatus. The apparatus is capable of receiving a backscattered signal from the fluid/coating interface. Such an apparatus that is compatible with the fluid is not disclosed in Toda in that there is no fluid in Toda. Further, the apparatus of claim 4 performs a method that is not disclosed in nor suggested by Toda, as explained above.

As to claim 6, Toda does not disclose a signal receiving means that is separate from the transducer, as recited in claim 6.

The Examiner rejected claims 1-6 under 35 U.S.C. 112, second paragraph, as being indefinite.

Claim 1 was rejected for the recitation of "the frequency" in step (e). Step (e) has been amended to recite the terms "frequency component of the set of frequencies." Step (d) and claim 4 were also amended for consistency. This is not a narrowing amendment.

Claim 2 was rejected for lack of antecedent basis for "the front surface" and "the main transmitting frequency." "Front surface of the coating layer" has been amended to "fluid/coating interface," which is recited in claim 1. Antecedent basis for "the main transmitting frequency" is found in claim 2 in "wherein said ultrasonic frequencies include a main transmitting frequency." Claim 2 was also rejected for reciting "it." This has been amended to "the reference signal." This is not a narrowing amendment.

Claim 3 was rejected for reciting "a resonant frequency." This is the same resonant frequency as in claim 1. The term has been cancelled from claim 3. This also corrects the lack of clear antecedent basis for "the resonant frequency." This is not a narrowing amendment.

Claim 4 was rejected because it was unclear how the amplitude of each frequency component was determined. The claim has been amended to recite a Fourier analyzer for deconvolving the trailing signal into a set of frequencies.

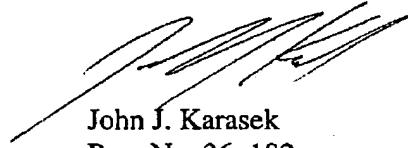
Claims 5 and 6 depend from and contain all the limitations of claim 4. The amendment to claim 4 obviates the rejection of claims 5 and 6.

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In view of the foregoing, it is submitted that the application is now in condition for allowance.

In the event that a fee is required, please charge the fee to Deposit Account No. 50-0281, and in the event that there is a credit due, please credit Deposit Account No. 50-0281.

Respectfully submitted,



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